Structure-Specific Flood Risk Assessment

Village of Ashland, Cass County, Illinois

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ABSTRACT

The Illinois Department of Commerce and Economic Opportunity (IDCEO) tasked the Illinois State Water Survey (ISWS) with developing a flood risk assessment for the Village of Ashland in Cass County, Illinois. The objectives of this project were to help raise flood risk awareness, provide tools to communicate flood risk, and support local efforts to reduce this risk. This project provides detailed data for each structure in the 0.2% annual chance floodplain in the community. The 0.2% floodplain is the largest magnitude frequency of flood hazard that is estimated for FEMA flood hazard mapping and encompasses the extents of lesser magnitude, higher frequency events. The risk data for each structure include the following: average annualized losses, flood depths for multiple return periods, and chances of flooding over a 30-year period. These data will assist the Village of Ashland in preparing a cost-benefit analysis that contributes to the development of a comprehensive plan of prioritized mitigation projects and can be included in the Cass County Hazard Mitigation Plan.

ACKNOWLEDGMENTS

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1. Introduction

Flooding causes damage to structures in Illinois nearly every year. Reducing losses due to flooding begins with information about the flood risk, and understanding structure-specific flood risk helps to prioritize mitigation projects. Under joint funding efforts from Illinois Department of Commerce and Economic Opportunity (IDCEO), Federal Emergency Management Agency (FEMA), US Army Corps of Engineers (USACE) Silver Jackets, and the Illinois Department of Natural Resources, Office of Water Resources (IDNR/OWR), collaborative work to develop structure-specific risk assessments across Illinois is being conducted by project partners at the ISWS, IDNR/OWR, and the USACE through the Silver Jackets Program. The Illinois State Water Survey (ISWS) received funding in December 2019 to develop a flood risk assessment for the Village of Ashland in Cass County from IDCEO, Structure Specific Flood Risk Assessment Studies Grant No. IDCEO 08-355061, Structural Risk (University of Illinois Grant Code D5950). The flood risk assessment uses flood hazard information from the FEMA Flood Insurance Rate Map (FIRM) and Study (FIS) for the subject area and additional flood simulations using hydrologic and hydraulic models for the area.

This report documents the development of the risk assessment. This report provides the Village of Ashland officials with background on the development of the risk assessment, and introduction to the data developed and how it may be used as well as access information to additional tools.

1.1. Project Area Background

Cass County lies within the Lower Illinois River HUC 07130011 and the Lower Sangamon River HUC 07130008. The Village of Ashland lies in the watershed of Indian Creek, a tributary to the Illinois River and is included in the Lower Illinois River HUC 07130011. The Village of Ashland was founded in 1857 (Ashland, Village of, 2020). The 2010 population of the Village of Ashland was 1,333 people. Figure 1 shows the location of the Village of Ashland.

FEMA FIRMs show areas that have a 1% chance each year of experiencing flooding, identified as a Special Flood Hazard Area (SFHA). In areas impacted by riverine flooding the SFHA represents the 1% annual chance floodplain. FIRMs for Cass County were elevated to a digital geospatial platform under the Map Modernization Program (FEMA, 2020). No updated hydrologic or hydraulic studies were performed or incorporated in the initial digital update to the FIRMs. The digital maps became effective for the entirety of Cass County on September 29, 2010. The Village of Ashland lies in the southeast corner of Cass County. A significant revision to the FIRM for the Village of Ashland was approved through the Letter of Map Revision (LOMR) process. The LOMR number 15-05-2462P, with effective date January 27, 2017, revised the floodplain for Little Indian Creek Tributary 1 and Little Indian Creek Tributary 1A in the Village of Ashland. The effective FIRMs show the 1 percent annual chance floodplain for Little Indian Creek Tributary 1A beginning where the cumulative drainage area of the stream drains 0.6 square miles in the northeast corner of the Village. Little Indian Creek Tributary 1A, flows through the Village and is the source of flooding examined in this study. The area is shown in Figure 2.

1.1.1. Flooding History

After storm events that occurred between September 13 and October 5, 2008, Cass County, Illinois was declared eligible for FEMA Hazard Mitigation Public Assistance Grants under the Major Disaster Declaration DR-1800 as of October 3, 2008. In 2019, Cass County again was declared eligible for FEMA Hazard Mitigation Public Assistance Grants based on the Major Disaster Declaration DR 4461 as of September 19, 2014, covering the storm incident period February 24 to July 3, 2019.

The Illinois Department of Natural Resources, Office of Water Resources (IDNR/OWR) designed and constructed a flood control project for the Village of Ashland with roadside ditch improvements and culvert upgrades, as shown in Figure 3. The Village of Ashland had experienced significant flooding events in July 1993 and May 1996 aggravated by undersized culverts (personal correspondence from IDNR/OWR).

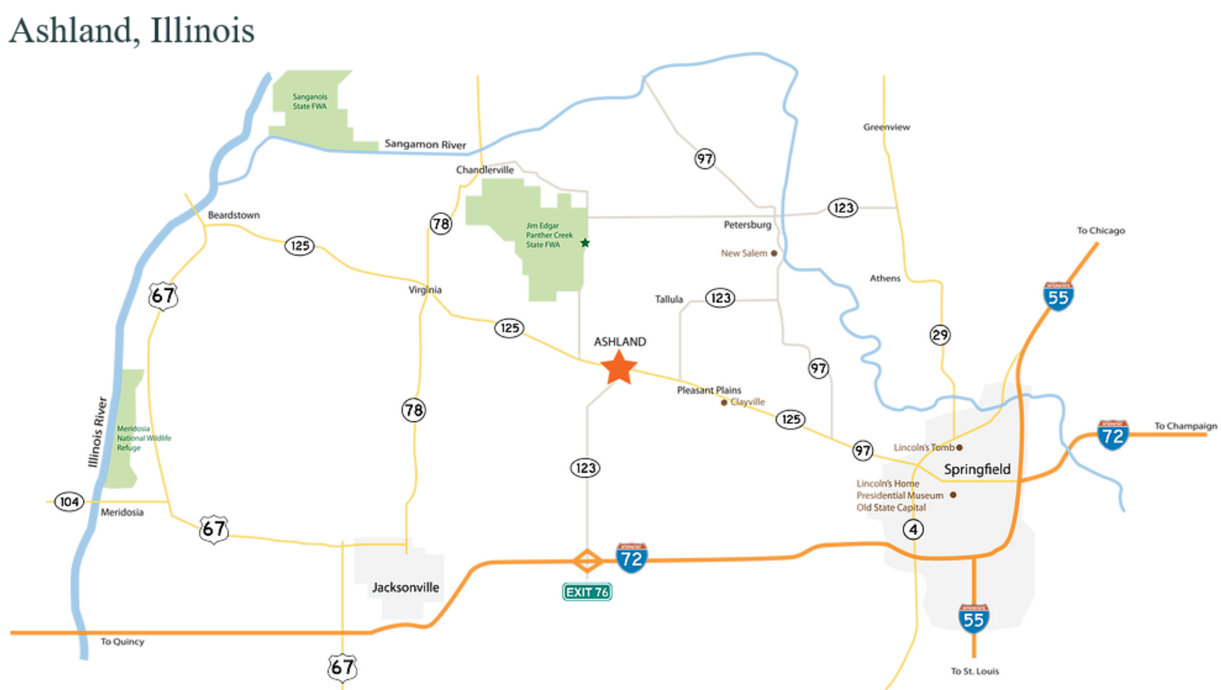

Figure 1 Village of Ashland Location Map (Ashland, Village of, 2020)

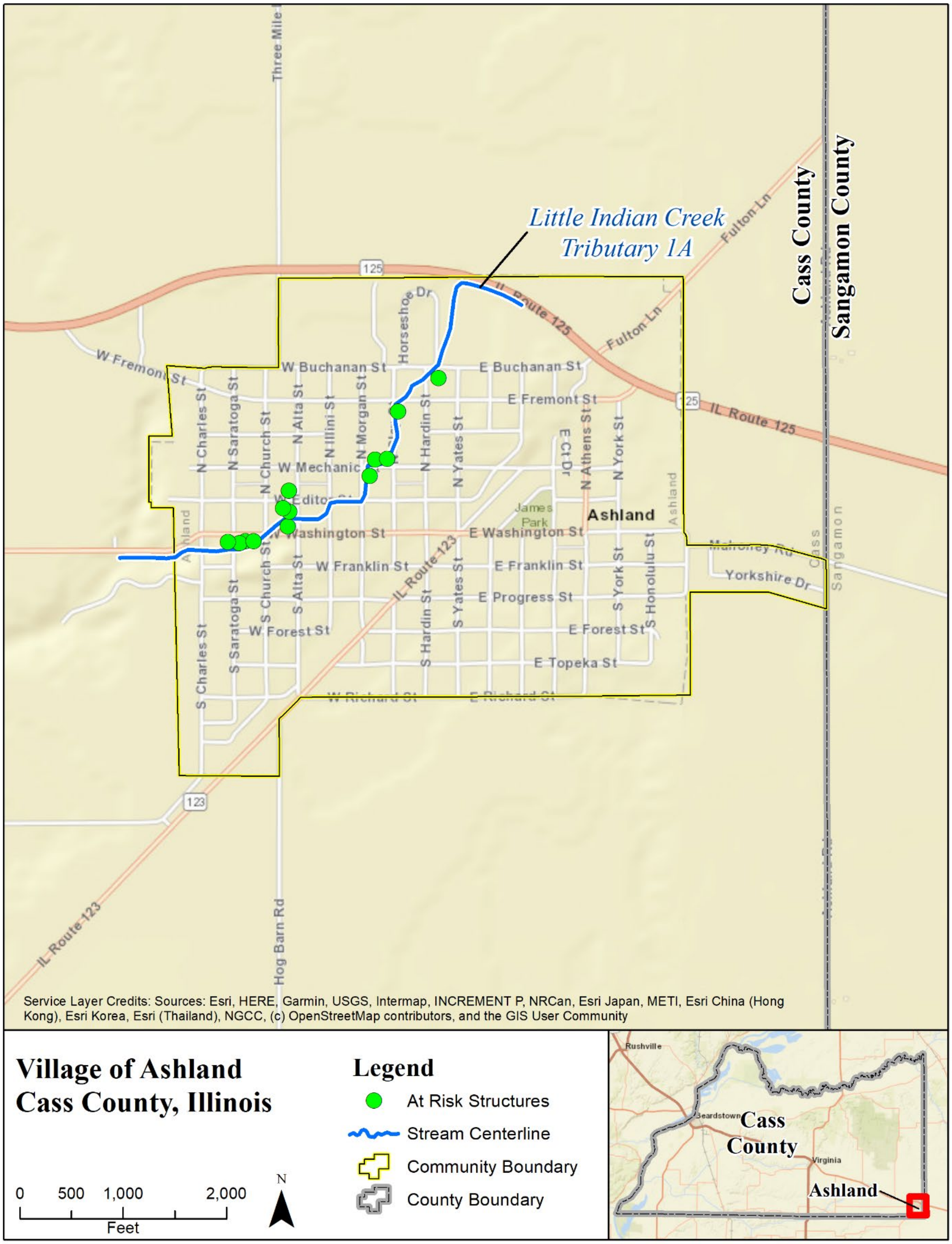

Figure 2. Map of Village of Ashland, Cass County, Illinois

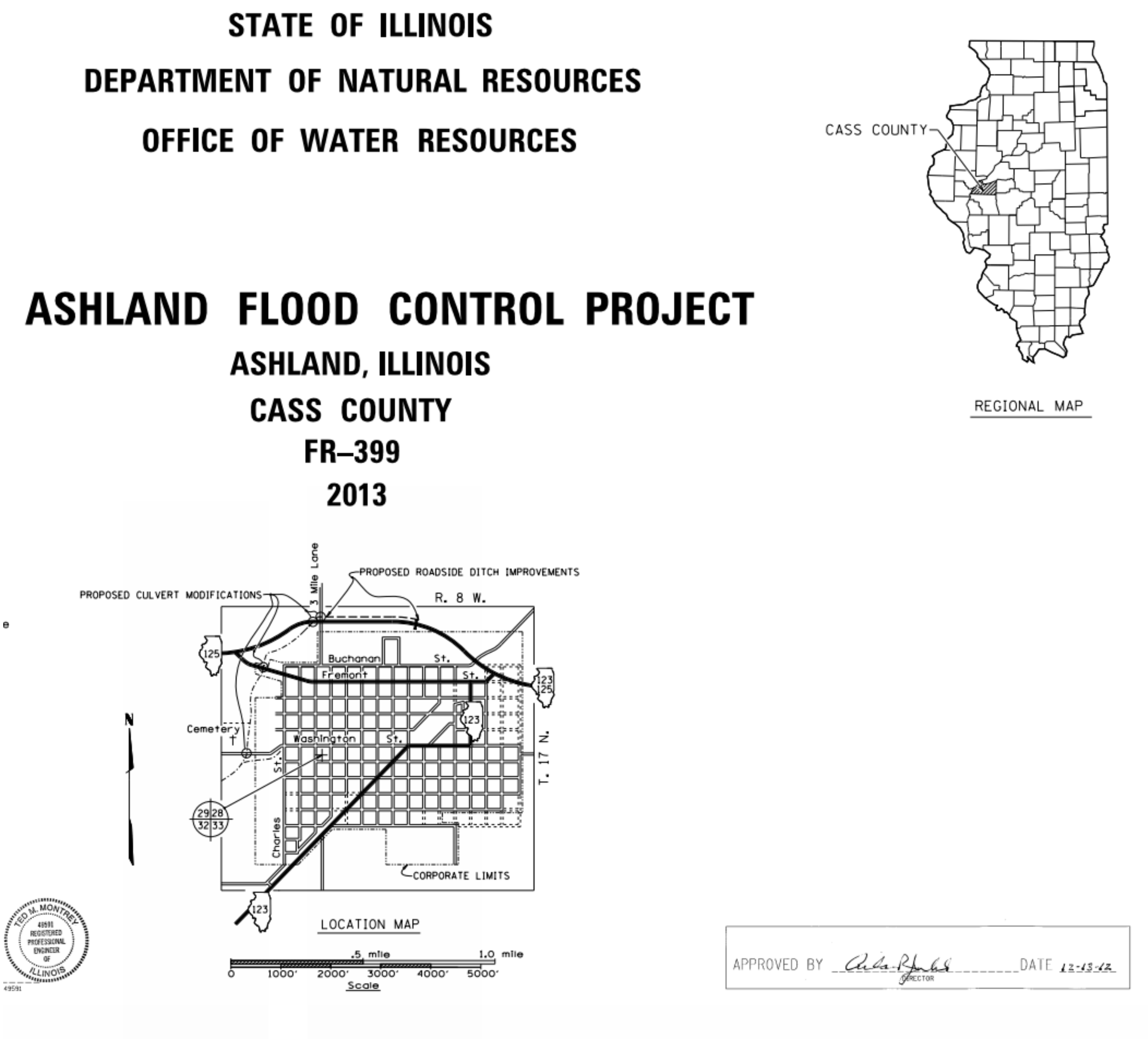

Figure 3. Ashland Flood Control Project Cover Sheet

1.2. Project Objective

The objective of the project is to provide the Village of Ashland and Cass County with structure-specific risk assessments of potential damages due to flooding. These potential flood-related losses, estimated on a structure-by-structure basis, can be used to prepare benefit-cost analysis and may be included in the county hazard mitigation plan to later support mitigation project funding. This analysis may be used to help build risk awareness and increase risk communication at the local level and to support local efforts to reduce natural hazard risk within the community.

The information compiled for the Village of Ashland contributes to the larger effort of a statewide database of structure specific risk assessments

2. Process

FEMA's Hazus program is recognized nationally for performing flood risk analyses. ISWS has used Hazus to support hazard mitigation plans for several counties in addition to running the analyses for multiple FEMA supported projects. Depth grids, elevation data, and assessor's parcel data are imported into Hazus (FEMA, 2019), and analysis can be performed for each structure in the project area.

2.1. Database

Under joint funding efforts from IDCEO, FEMA, USACE Silver Jackets, and IDNR/OWR, collaborative work to develop structure-specific risk assessments across Illinois is being conducted by project partners at the ISWS, IDNR/OWR, and the USACE Silver Jackets Program. Village of Ashland data from the Hazus analyses are available via a Statewide Geospatial Structure-Based Flood Risk Assessment Database, which can be accessed on the Structures at Flood Risk (SAFR) website. The website contains property value information and flood risk and is password protected. The web address is: http://illinoisfloodmaps.org/structureriskassessment/floodriskdb/. Please contact Lisa Graff at the Illinois State Water Survey (lgraff@illinois.edu) for login and password information.

The intended audiences for the website are state and local officials and agency staff and particularly floodplain managers, mitigation officers, and city planners. The SAFR database supports the creation of maps that may be used to illustrate priority areas for mitigation action.

2.2. Deliverables

The deliverable for this project is a geospatial database of structure-based flood risk assessments and all supporting data layers, including:

- Structure-specific information
- Depth grids
- Chance of flooding grids
- Estimated loss information
- Community-specific structure-based flood risk assessment
- Report for the Village of Ashland

3. Methodology

The Structure-Based Flood Risk Assessment methodology follows a workflow to gather the data required for Hazus analyses which is be divided into four phases, as shown in Figure 4.

Phase 1. Data Collection includes the development of the initial project extent and structure selection.

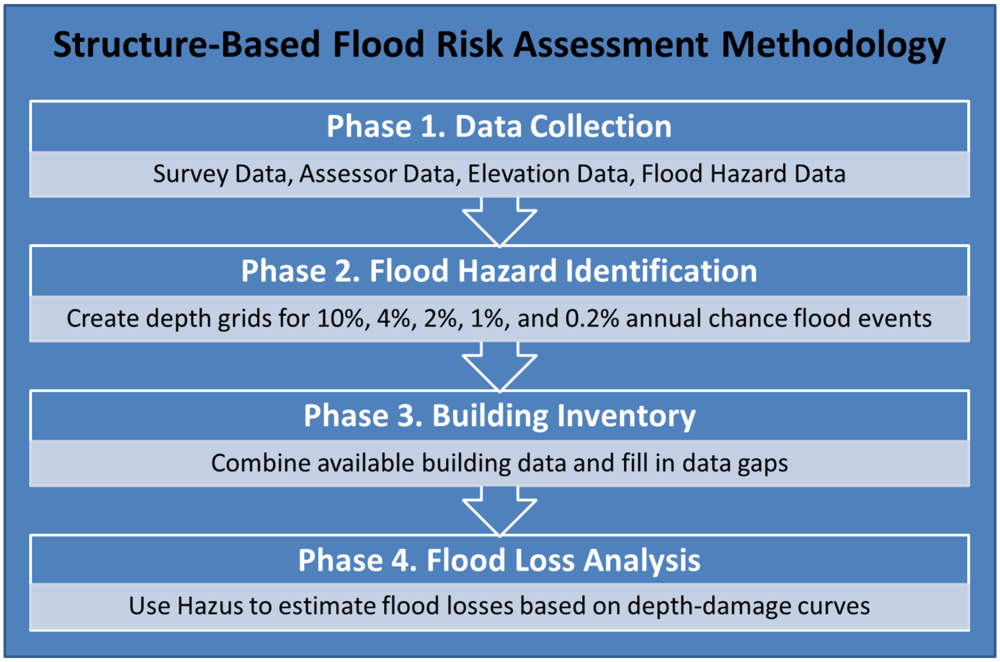

Figure 4. Steps in Assessment Methodology

Phase 2. Flood Hazard Identification includes the development of multiple depth grids that represent the flood hazard for the study areas. The depth grids produced to complete an average annualized loss analysis include the 10%, 4%, 2%, 1%, and 0.2% annual chance flood events. Flood elevation data are used to compute water surface elevations. Ground elevations are then subtracted from the water surface elevations to determine flood depths.

Phase 3. Building Inventory includes completing an inventory of structures at risk of flooding in the 0.2% annual chance floodplain. To complete the most accurate estimate of flood risk for structures, certain information about each at-risk property must be collected.

Phase 4. Flood Loss Analysis includes loading the depth grids created in Phase 2 and the building inventory compiled in Phase 3 into Hazus. An analysis is then performed for each annual chance flood event represented by the depth grids. This analysis will result in the generation of loss estimates for the 10%, 4%, 2%, 1%, and 0.2% annual chance flood events for every structure included in the building inventory. An average annualized loss for each structure will then be calculated from these results.

3.1. Project Area Selection

The Village of Ashland in Cass County was selected for the structure-based risk assessment based on the availability of data necessary to complete the study, including detailed flood study information, topographic data, and project budget.

3.2. Hydrology and Hydraulics

Little Indian Creek Tributary 1A flows through the Village of Ashland. The drainage area of Little Indian Creek Tributary 1A is 0.6 square miles in the northeast corner of the community and drains 1.4 square miles as it exits the community's west corporate limit.

The effective FIRM for Little Indian Creek Tributary 1A is based on hydrologic and hydraulic models submitted under Letter of Map Revision (LOMR) 15-05-2462P, which became effective January 27, 2017. The hydrologic and hydraulic analysis for LOMR 15-05-2462P was developed by the IDNR-OWR to revise the Village of Ashland's floodplains based on a flood control project. These models were accessed from the FEMA Engineering Library. The LOMR analysis only included the 1% annual chance flood frequency simulation used for floodplain mapping. Some modifications were necessary to generate the data used in the Hazus analyses which requires multiple flood frequency events.

The hydrologic analysis for the Village of Ashland FIRM used the USACE rainfall-runoff modeling software, HEC-1. The hydrologic model used rainfall depths based on Bulletin 70 (ISWS, 1989) and a 3rd quartile Huff temporal distribution (Huff, 1990). The HEC-1 model produced peak flows that were adjusted based on the capacity of local storm sewers to intercept overland flows.

The hydraulic analysis for the Village of Ashland FIRM used the USACE hydraulic modeling software, HEC-RAS. Peak flow rates from the hydrologic analysis were input to the hydraulic model. The hydraulic model routes the flow to assess the extent of riverine floodplains and overland flow paths in the Village of Ashland.

For this flood risk assessment, the additional flood frequencies of 10%, 4%, 2%, and 0.2% were added to the HEC-RAS model. Some simplifications were made to the HEC-RAS model, allowing it to run without errors for reaches that would normally not experience overland flooding during the less magnitude and more frequent 10% and 4% events. The resulting elevations for each flood frequency at the modeled cross section locations were used to create flood depth grids. Figure 5 shows the 1% annual chance floodplain for Little Indian Creek Tributary 1A (the subject of this study) as well as Little Indian Creek Tributary 1. Currently there are no structures in the floodplain of Little Indian Creek Tributary 1.

Figure 5. Stream of interest: Little Indian Creek Tributary 1A

3.3. Flood Hazard Identification

The hydrologic and hydraulic model results combined with GIS technology were used to identify the flood hazards in the study area. Estimation of flood damage requires the depth of the flood water affecting the structure. The elevation of the flood water is approximated by developing water surface elevation grids, flood depth grids are calculated by subtracting the ground elevation.

For this project, depths for the 10%, 4%, 2%, 1%, and 0.2% annual chance flood events were calculated, and depth grids were created. Other depictions of risk in the floodplain were also made based on these products, including the percent annual chance of flooding and the chance of flooding over a 30-year period.

These products were created in a grid format, which allows the values to be estimated across the entire study area and not only at certain points of interest. Values of flood depths, percent chance of flooding, and chance of flooding over a 30-year period are available for structures within the study area and parcels that are vacant. These data are valuable for current property owners or community planners and developers who may be looking to expand into undeveloped areas.

3.3.1. Water Surface Elevation Grids

A water surface elevation (WSEL) grid is a GIS-formatted dataset that represents the elevation of the water during a specified flood event. WSEL grids form the basis from which the depth, percent annual chance of flooding, and percent chance of flooding over a 30-year period grids were generated.

Using GIS software, WSEL grids were calculated by taking water surface elevations at cross sections and interpolating between those elevations, creating a triangulated irregular network (TIN). The TIN-to-raster tool is then used to create a floating-point raster of water surface elevations using the linear method.

For the Village of Ashland, the water surface elevations were prepared using modeling described in the hydrology and hydraulics section.

3.3.2. Depth Grids

A depth grid is GIS-formatted data that represent the extent and depth of flooding for a given annual chance event. Depth grids are in a GIS digital raster dataset that defines geographic space as an array of equally sized square cells arranged in rows and columns. Each cell contains a value representing water depth. Factors that contribute to the resolution or level of detail displayed by a depth grid are twofold, consisting of the resolution of the terrain data and availability of water surface elevation information.

Flood depth grids were produced for Little Indian Creek Tributary 1A for the 0.2%, 1%, 2%, 4%, and 10% annual chance flood events. Cells within the inundated area of the depth grids represent the expected flooding depths associated with the represented flood event.

Ground elevation grids were generated from LiDAR data that were developed for Cass County in 2017. This technology was used to create a Digital Terrain Model (DTM) with a cell size of 2 feet by 2 feet. Depths were determined using GIS software raster calculations based on water surface elevation and ground surface elevation raster grids.

The difference between the expected water surface elevation and ground surface elevation was used to generate the depth grid. The cell size for each depth grid is the same as the DTM from which they were derived.

Figure 6. 1% annual chance flood depth grid.

3.3.3. Percent Annual Chance of Flooding Grid

The Percent Annual Chance of Flood grid represents the annual chance of flooding from 0.2% to 10%, and every probability in between. This grid can be used to show the variety of risks that exist within the mapped floodplains and floodways on a FEMA FIRM. Not all properties within the 1% annual chance floodplain have the same probability of flooding each year.

The Percent Annual Chance of Flooding grid was computed using multiple water surface elevation results and their associated percent annual chance of exceedance (e.g. 0.2%, 1%, 2%, 4%, and 10%) and interpolating the percent annual chance of flooding at each grid cell based on those inputs coupled with the ground elevation at each specified point. This method uses an order 1 (first degree) linear regression for polynomial fit. The polynomial is fit using the natural log of the percent annual chance of flooding (x-axis) and y values (flood elevation) are not transformed. This "semi-log," transformation is recommended when values are close together. After the equation for the best-fit line is found, the ground elevation is input to find the annual chance percentage. This process is run for each pixel in the grid. An example of the presentation of the results is provided in Figure 7.

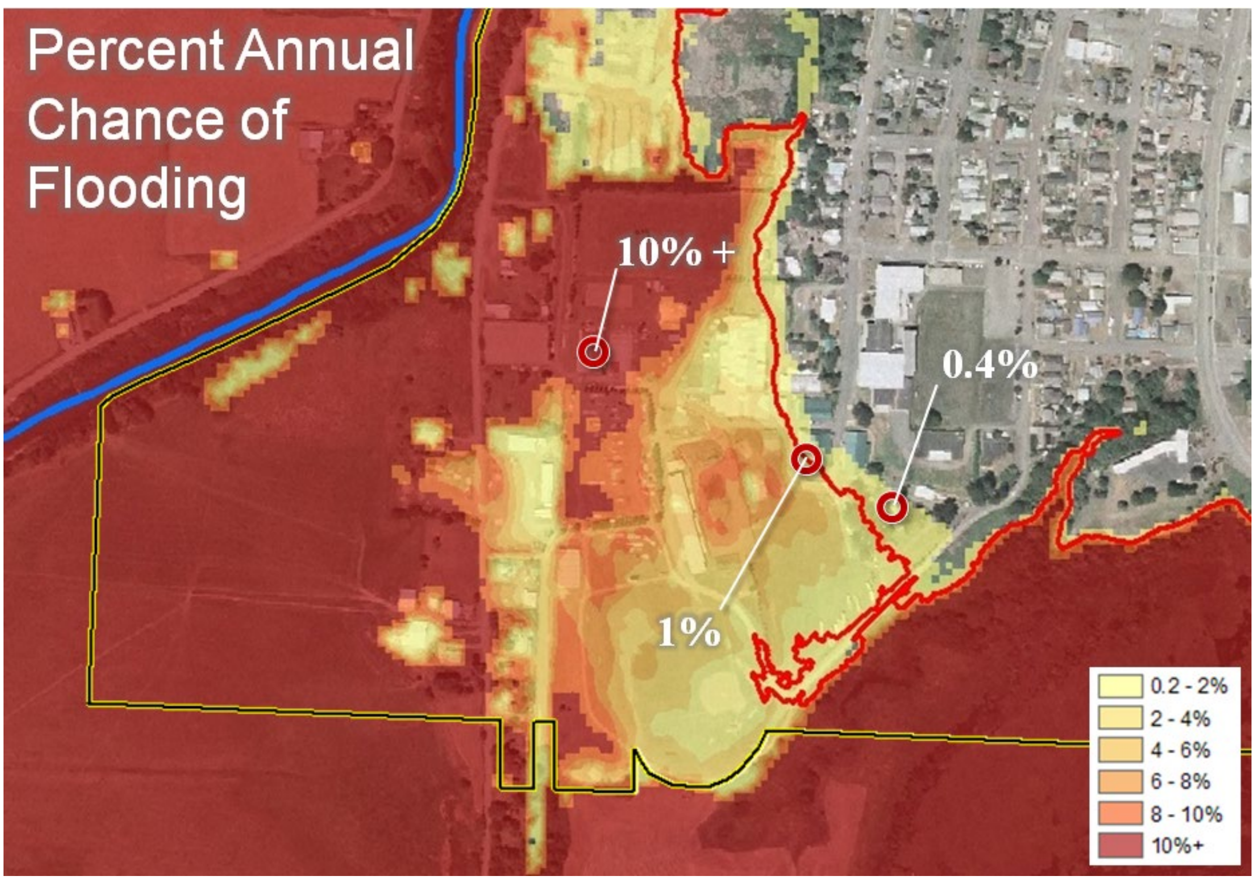

Figure 7. Example percent annual chance of flooding grid.

3.3.4. Percent Chance of Flooding over a 30-year Period Grid

The Percent Chance of Flooding over a 30-year Period Grid represents the percent chance of flooding at least one time during a 30-year period for a given cell or location within the mapped floodplain. An example of the results is provided in Figure 8. Once the Percent Annual Chance Grid is developed, the process to develop the Percent 30-year Chance Grid uses the following statistical equation:

Probability = 1 – (1-p) n where:
p = percent annual chance of flooding (values derived from the Percent Annual Chance raster layer)
n = time period in years (30 years for this dataset).

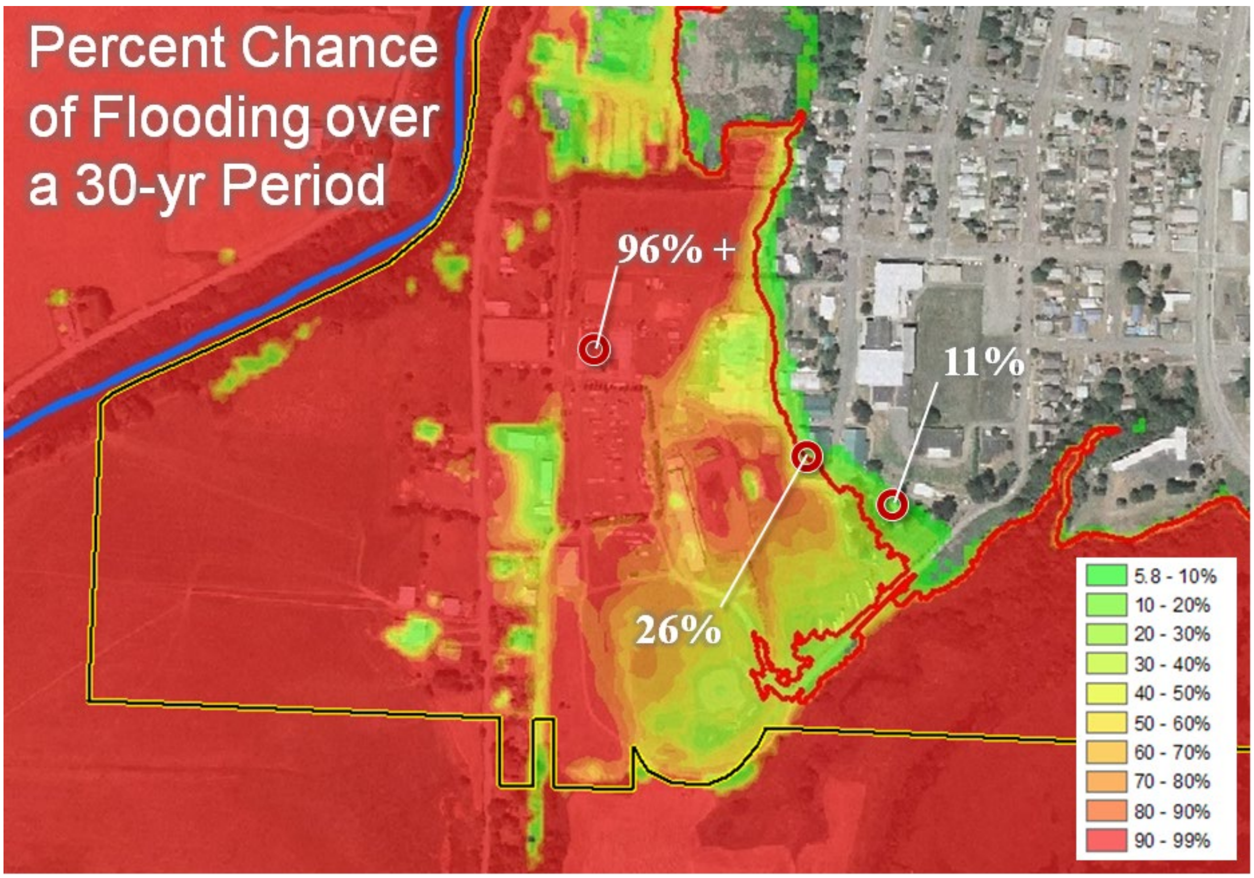

Figure 8. Example percent chance of flooding over a 30-year period grid

3.3.5. Building Inventory Creation

A structure-based risk assessment requires a GIS point-based building inventory. The information collected for each structure includes, but is not limited to, parcel identification number, address, flooding source, building occupancy class, foundation type, number of stories, assessed building value, and the square footage of the structure. Once the structures to be included in the building inventory were finalized, a GIS point feature class was created from the centroids of the available building footprints as a standard practice. Hazus assigns the depth of flooding for the structure based on the depth grid cell that the structure point intersects. Therefore, some adjustments were necessary for structures with footprints not fully covered by the depth grids, showing partial inundation. Figure 9 shows an example of a partially inundated structure for which the point representing the structure would be adjusted to intersect the flood depth grid. This ensures that these structures are counted toward the damages that are calculated by Hazus.

Point centered on structure (left), adjusted point (right)

Figure 9. Example of structure point location adjustment

4. Hazus Analysis

Hazus is a mitigation loss estimation tool developed by FEMA that uses GIS technology to estimate physical, social, and economic losses associated with a natural disaster. Hazus contains three main disaster modules: earthquake, flood, and hurricane. For this analysis, the flood module was used to estimate the physical losses for the 10%, 4%, 2%, 1%, and 0.2% annual chance modeled flood events. The average annualized loss was then calculated using these events. Hazus has three general levels of analysis, as identified in Figure 10.

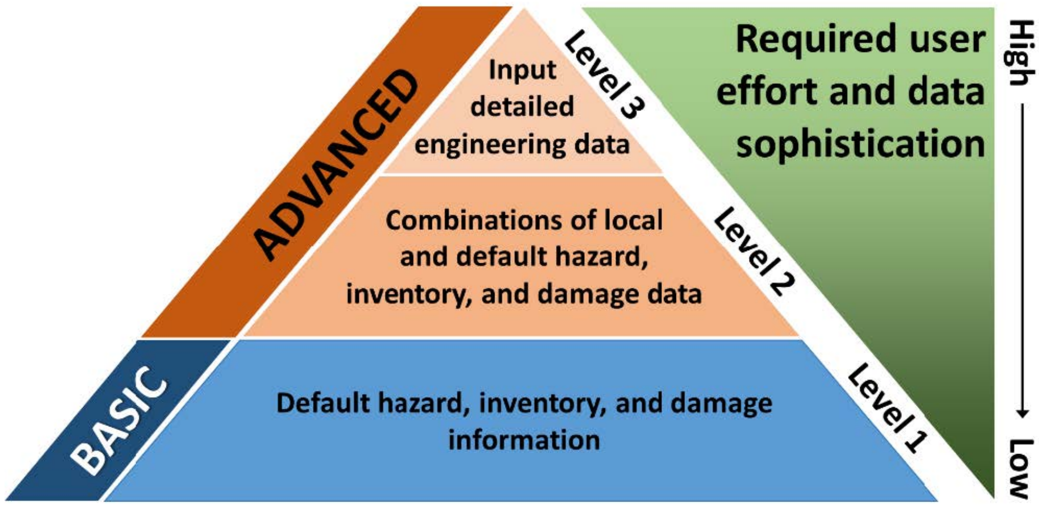

Figure 10. Levels of Hazus analysis

A Level 2.5 analysis was performed for this flood risk assessment by incorporating local assessor's data in a structure-specific building inventory and using depth grids created from the flood study in the LOMR.

4.1. User Defined Facility (UDF) Analysis

Unlike a Level 1 analysis, which uses the default Hazus General Building Stock (GBS) aggregated to the census block level, a Level 2 User Defined Facilities (UDF) analysis accounts for each individual structure. The structure inventory created for this project was formatted for a Hazus UDF analysis.

Hazus analyzes each structure using depth-damage curves developed by the USACE. The depth-damage curves estimate losses by assigning a damage percentage to the structure, based on the depth of water at that location. Depth of water is based on the depth grid, first floor height, and location determined by the latitude/longitude value for the structure. Hazus chooses the proper depth damage curve from over 700 available for each structure based on the attributes of the structure, such as occupancy class, foundation type, and building materials.

4.2. Building Attributes for Hazus Analysis

Although most of the categories used for a Hazus UDF analysis could be derived from assessor's data, not all are included in their database. Thus, some of the fields in the structure inventory had to be attributed through other methods. The following is a brief description of fields and how they were populated if no values were provided. The method used is documented in the database for each structure.

<u>Building cost</u>: The assessed building value for each structure was multiplied by three to create an estimated fair market value. This calculation was undertaken because a law passed in 1975

determined that the assessed value of a property in Illinois is approximately one-third the Fair market value (FMV) (Shrestha, 2014).

Content cost: Content cost represents an estimate of the value of the structure contents. It is calculated by multiplying the building cost by a Content Cost Factor (CCF), which is determined by the occupancy class of the structure.

Square footage: Provided in the Cass County 2018 assessor's data.

Number of stories: Provided in the Cass County 2018 assessor's data.

Year built: Provided in the Cass County 2018 assessor's data.

Foundation type: Provided in the Cass County 2018 assessor's data.

First floor height (FFH): This represents the height of the first floor, in feet, above the lowest adjacent grade. To determine FFH, images of the homes available on Google Streetview were referenced and used to estimate the height above grade of the first floor. The "counting steps" method was used to determine the FFH for this project. Standardization of the step rise in building codes makes counting steps up to a first floor a relatively accurate method for estimating FFH. A stair height of 7 inches is assumed when using this method, as there is a maximum riser height of 7.75 inches as per the International Building Code (ICC, 2018)

It is important to emphasize that while these estimates are an important tool in identifying flood risk, they are estimates and as such are subject to error. Caution is advised when interpreting the results.

5. Flood Risk Assessment Results and Products

5.1. Flood Risk Assessment

The Flood Risk Assessment provides an estimate of potential financial consequences associated with flooding for structures located within the 0.2% annual chance floodplain. Estimates of potential flood losses for each structure were generated for the 10%, 4%, 2%, 1%, and 0.2% annual chance flood frequencies. Average annualized loss was calculated using the results from these five flood frequencies. The data are calculated on an individual structure basis but can be aggregated to larger planning areas, such as neighborhoods, watersheds, flooding sources, or other geographic areas of interest. This dataset can enhance the understanding and visualization of where floods will occur and the degree of risk that exists from flooding within the identified floodplain. Risk levels were defined to summarize data based on inundation by the 1% annual chance flood.

5.2. Flood Risk Assessment Results

This flood risk assessment analyzed the impact of flooding along Little Indian Creek Tributary 1A as it flows through the Village of Ashland. A total of 13 structures were identified as being within the 0.2% annual chance flood event area, 12 single-family residential structures and 1 commercial. Of these, 11 were shown as potentially incurring damages in the Hazus flood risk analysis for the 0.2% annual chance flood event. A risk level was assigned to each of the Ashland structures based on a range in feet of flooding above the first finished floor for the event. Risk levels are defined in Table 1. It is important to note that a Low risk level, when the first floor is above the 1% flood, that flooding below the finished floor elevation can still damage the subfloor structural materials and HVAC and electrical systems that are located in the crawlspace.

Table 1. Risk Levels

Risk Level	1% Annual Chance Flood Height Above First Floor Elevation (feet)
High	Greater than 1.5'
Moderate	0' - 1.5'
Low	Less than 0'
Very Low	Structures located outside the 1% Annual Chance Floodplain

Table 2 shows the total losses in US 2019 dollars (2019 USD) for percentages of annual chance events and the average annualized losses for each analyzed flood event for the four structure risk levels. Expected flooding is shallow, and no structures are in the High to Moderate risk level. However, even a few inches of water can cause damage as shown in Table 2. Information sheets have been prepared for each structure that potentially incurs damages and can be found in Appendix A. The information sheets were produced using the tools on the SAFR web site. Data provided includes, but is not limited to the expected damages and depth above first finished floor for all events, and expected frequency of flooding over 30 year period.

Table 2. Economic Losses by Event and Risk Level (2019 USD)

Structure Risk Level	*10% Total Losses*	*4% Total Losses*	*2% Total Losses*	*1% Total Losses*	*0.2% Total Losses*	*Average Annualized Losses*
Number of Structures Impacted	5	5	5	6	11	11
High	$0	$0	$0	$0	$0	$0
Moderate	$0	$0	$0	$0	$0	$0
Low	$33,120	$33,120	$35,140	$37,300	$43,300	$3,460
Very Low	$0	$0	$0	$0	$30,050	$230
Grand Total	**$33,120**	**$33,120**	**$35,140**	**$37,300**	**$73,350**	**$3,690**

6. Benefits and Uses of Annualized Losses

The Flood Risk Assessment helps guide community mitigation efforts by quantifying future potential flood losses, thereby showing where flood mitigation actions may produce the highest return on investment. Average annualized losses (AAL) are intended to show the cost per year of keeping a property at its current level of flood risk. The AAL numbers can be used to calculate benefit-cost for mitigation projects. The information and data created through this project also provide the Village of Ashland and Cass County with the tools to identify strategies in the Natural Hazard Mitigation Plans for Cass County and the State of Illinois. These strategies include mapping areas that are unsuitable for development; prioritizing flood proofing, relocation, and elevation; and developing flood risk educational materials.

6.1. Hazard Mitigation

According to FEMA, hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters (FEMA https://www.fema.gov/hazard-mitigation-planning). Flood risk assessment data are essential for hazard mitigation planning activities, including developing mitigation strategies and completing a risk and vulnerability assessment. To reduce risk in a community, there needs to be a clear picture of the physical and financial impacts of potential floods. Once the impacts of flooding to homes, businesses, critical facilities, and other infrastructure are determined, targeted actions can be planned.

A structure-specific risk assessment based on up-to-date, relevant, and spatially accurate data is an effective tool for decision makers and aids in the prioritization of flood mitigation objectives and actions. Mitigation options can be prioritized using the specific structure-based flood risk data such as first flood height, flood depth, percent damage, and building details. These attributes can help determine the best course of action for a property or group of properties, including flood-proofing, relocation, elevation, as well as demolition of at-risk properties.

6.2. Selecting Mitigation Options

Flood risk assessment data are highly useful for a multitude of mitigation applications. Quantifying the flood risk that is easily aggregated for multiple flood scenarios allows the data to be scaled for different purposes. Information at a sub-watershed level can be used to target mitigation strategies that may modify the floods themselves, using flood and stormwater management approaches such at retention, detention, and green infrastructure. Having the data at a per-structure basis allows for scalable screening of the cost effectiveness of different mitigation options that modify the susceptibility and impact of flooding in the community. This project data can help to identify areas where flood mitigation activities are most needed, especially when combined with other flood loss data, such as repetitive loss properties. Using these data together can help to identify locations where at-risk property buyouts can strategically occur throughout the community.

Flood risk assessment data can also be used to compare two or more mitigation options in a certain flood-prone area to enable selection of the more effective and appropriate action. The data can be used to identify flood risk "hot spots," which can help decision makers better understand the flood risk in their communities. The data can also be used to evaluate whether the adoption of a new building code would be effective, or how cost-effective flood proofing measures may be.

Frequently a structure that floods many times at a lower magnitude event can accumulate more damage than a single high-magnitude flooding event. The average annualized loss number reflects this situation. A structure subject to frequent damage from relatively small events may benefit from a non-structural flood mitigation measure.

7. Evaluating Cost Effectiveness of Potential Mitigation Projects

FEMA's Hazard Mitigation Assistance (HMA) programs all require projects to be cost-effective to be eligible. Cost-effectiveness is evaluated through the FEMA Benefit Cost Analysis (BCA) modules or other modules that have received FEMA's prior approval. Several different BCA modules address flood risk.

Flood depth grids will significantly help with project screening and development. For example, areas that are subject to damage by more frequent floods, such as the 10 percent annual chance flood, generally make better candidates for meeting the cost-effectiveness requirements of HMA programs. Multiple return frequency flood depths for specific properties may also be useful in supplementing data required to develop a BCA using FEMA's BCA flood module, such as predicting future losses at different return frequencies in the absence of historical damages. The results of the loss estimates in this project may alert community officials and planners to areas that merit a full-scale BCA to evaluate cost-effectiveness.

The FEMA website provides more information on HMA grant programs: https://www.fema.gov/hazard-mitigation-grant-program.

7.1. Building Code Requirements

Risk assessment data can help building officials, property owners, and developers understand the elevation requirements for specific sites according to local flood damage prevention ordinances and/or building codes. It also improves the ability to identify areas requiring higher building code requirements or the use of flood-resilient designs and construction materials.

7.2. Community Investment (Capital Improvement Planning)

The flood risk data can also be used in formulating community budgets and capital expenditures, including infrastructure such as drainage system upgrades and road upgrades. If a community is evaluating maintenance or repair needs on a road or developing new infrastructure in previously undeveloped areas (e.g., new roads, water, and sewer services), the community can consult the datasets to determine if a higher flood risk mitigation standard is needed for construction or reconstruction. For example, knowing the depth of flooding from multi-frequency flood events at various locations could influence siting of future infrastructure. These datasets could also help guide strategic infrastructure investment and the resulting future land use in rapidly growing areas.

7.3. Floodplain Management and Community Rating System

Flood risk data can be used to justify an investment in resources for managing the risk through programs such as the Community Rating System (CRS), which provides financial incentives for participation. The CRS program gives credit points to many of these types of activities, including public information and flood damage reduction activities (e.g., floodplain management planning, acquisition/relocation of flood prone properties) and flood protection projects. Flood risk assessments show details of potential future flood losses of critical facilities using Hazus. If the community used this information and determined a need to adopt a more stringent flood protection standard for critical facilities, they could receive CRS credit points after following through with the adoption. Each accumulation of credit points that improves a community's CRS class rating results in a greater premium reduction for all community National Flood Insurance Program (NFIP) policy holders (FEMA, 2011).

Additional CRS credit is available for communities that develop a public information strategy and make a special effort to contact residents and property owners in hazardous areas. To get this credit, communities collect or prepare fact sheets and case studies; hold special events like "flood awareness week"; give workshops to nonprofit organizations, professional associations, or the general public; or perform other similar activities. Additional information on the CRS program can be obtained from the State NFIP coordinating agency or community floodplain administrator.

7.4. Public Outreach

Education and outreach are needed to inform the general public, property owners, decision makers, design professionals, educators, and developers about their community's hazards and to promote mitigation. By continually communicating with and engaging the public on flood risk issues, citizens can be more aware of the risks they face, what they can do about it, as well as actions the community is taking to reduce those risks. A public outreach plan can include in-person meetings, a public information website, information fact sheets, and other planning resources. The structure-specific risk assessment provides data in a convenient format for mailing property-specific risk profiles that communicate the risk faced by each property owner. The SAFR site creates property-specific risk assessment result handouts in a printable format. Engaging the public builds support necessary to further identify and fund more active types of mitigation projects.

8. Conclusions

Products created for this project include the flood risk assessment data comprising estimated losses for the 10%, 4%, 2%, 1%, and 0.2% annual chance flood events, as well as an average annualized loss number. Also included in flood risk data are the depth grids for all the flood events, as well as grids that reflect the chance of flooding each year and the chance of flooding over a 30-year period. Using this information, planners and officials can identify where risk reduction efforts may produce the highest return on investment. This can inform policy decisions about which mitigation actions are pursued and how they are prioritized. It may also provide a baseline against which to evaluate loss reduction upon future updates or changes.

These data can also enhance the understanding and visualization of where floods will occur and the degree of risk that exists from flooding within the mapped floodplain. This information can be useful for identifying vulnerability in terms of flood severity and frequency of occurrence, enhancing the existing building code, or providing data needed for a Benefit Cost Analysis for mitigation projects. Provided with this robust information, communities can make more informed decisions, formulate strategies for reducing losses from flooding, and support project funding decisions. Although historically most emphasis has been placed on whether a property was “in or out” of the 1% annual chance floodplain, communities will now be able to see the significant variation of risk to properties within the entire mapped floodplain, facilitating the strategic reduction of flood losses.

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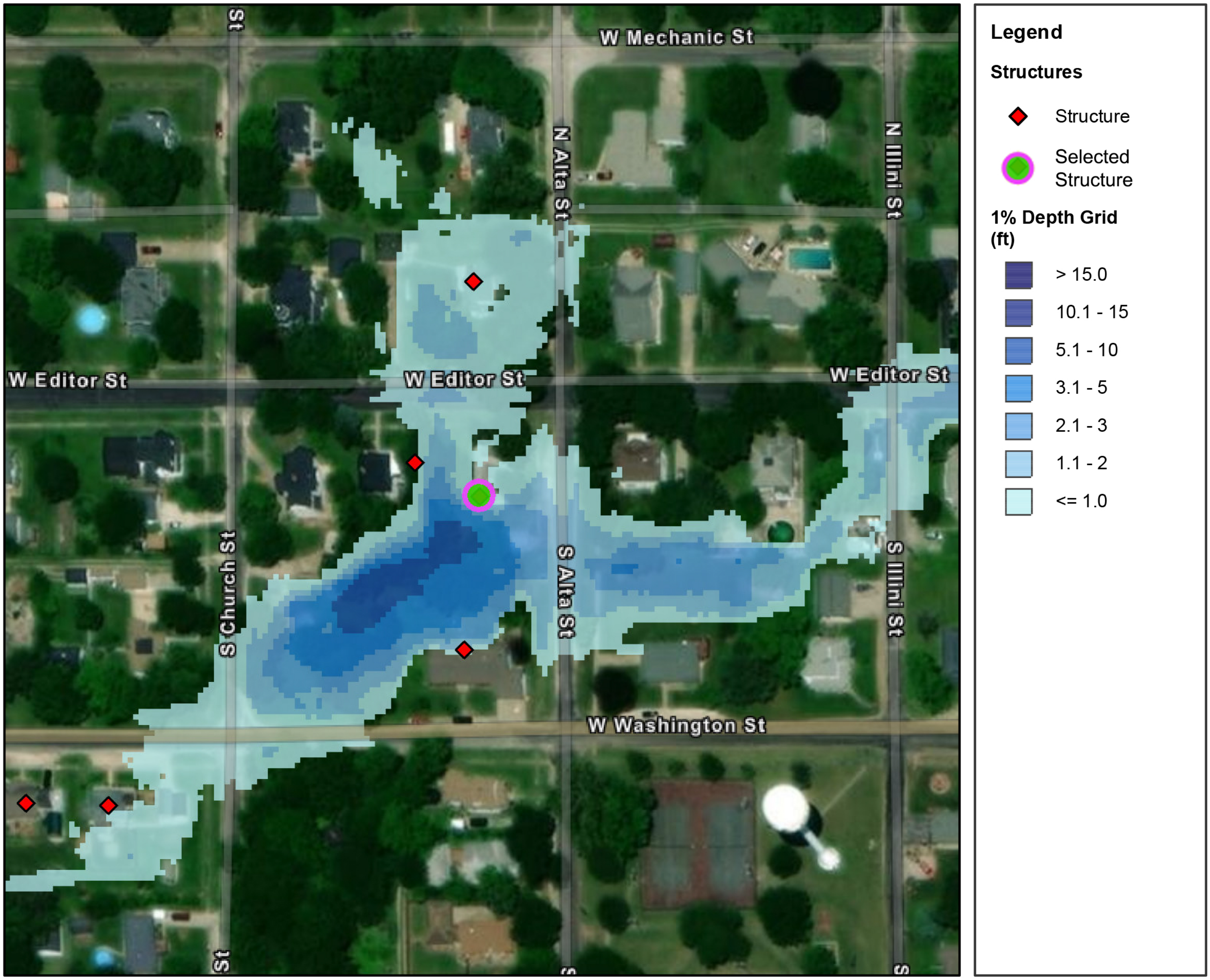
Appendix A

Property Information Sheets



100 S ALTA ST, ASHLAND, IL, 62612 — PIN 02-035-010-00

Property Info:

Building Value (2019 US$)
32,004

Stories
1

Area (Sq Ft)
960

Foundation Type
Basement (or Garden Level)

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	-1.52	16.42	5,260
4%	-1.52	16.42	5,260
2%	-1.52	16.42	5,260
1%	-1.46	16.72	5,350
0.2%	-1.04	18.82	6,020

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

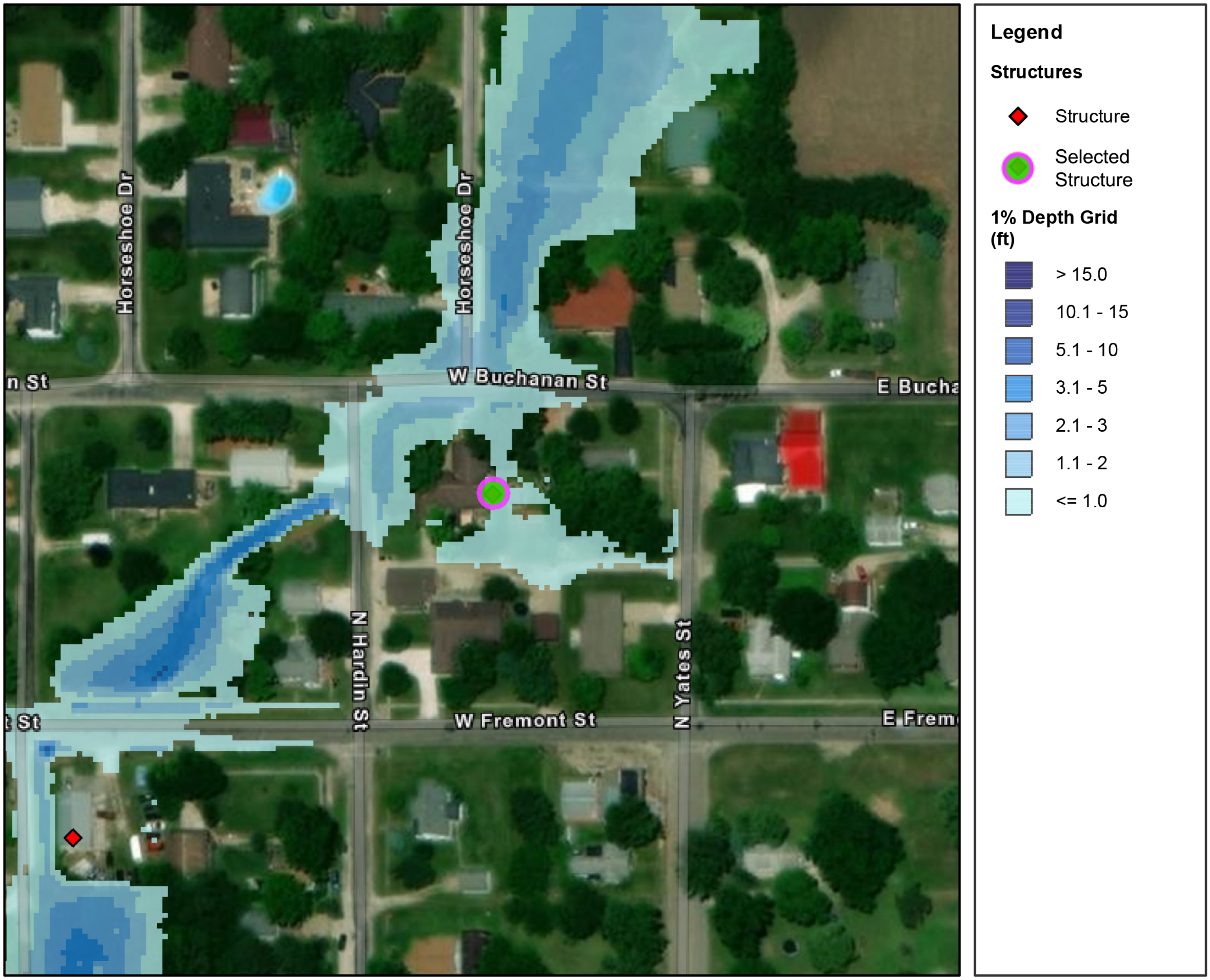
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



106 W BUCHANAN ST, ASHLAND, IL, 62612 — PIN 02-017-008-01

Property Info:

Building Value (2019 US$)
45,727

Stories
1

Area (Sq Ft)
2,730

Foundation Type
Crawlspace

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	-1.87	0.39	180

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

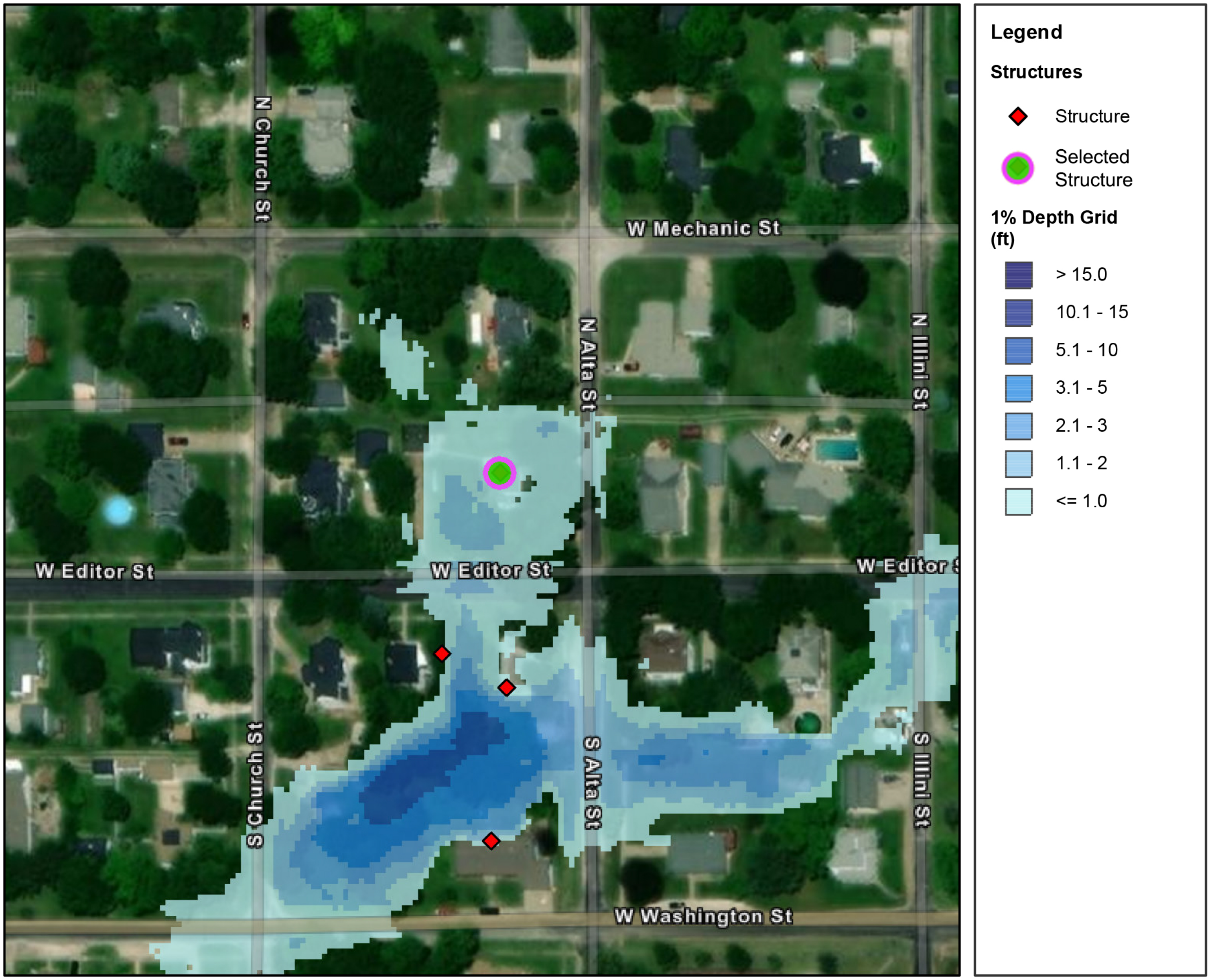
Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



108 N ALTA ST, ASHLAND, IL, 62612 PIN 02-027-002-00

Property Info:

Building Value (2019 US$)
52,466

Stories
2

Area (Sq Ft)
2,736

Foundation Type
Slab

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	-1.72	0.84	440
4%	-1.72	0.84	440
2%	-1.72	0.84	440
1%	-1.66	1.02	540
0.2%	-1.24	2.28	1,200

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

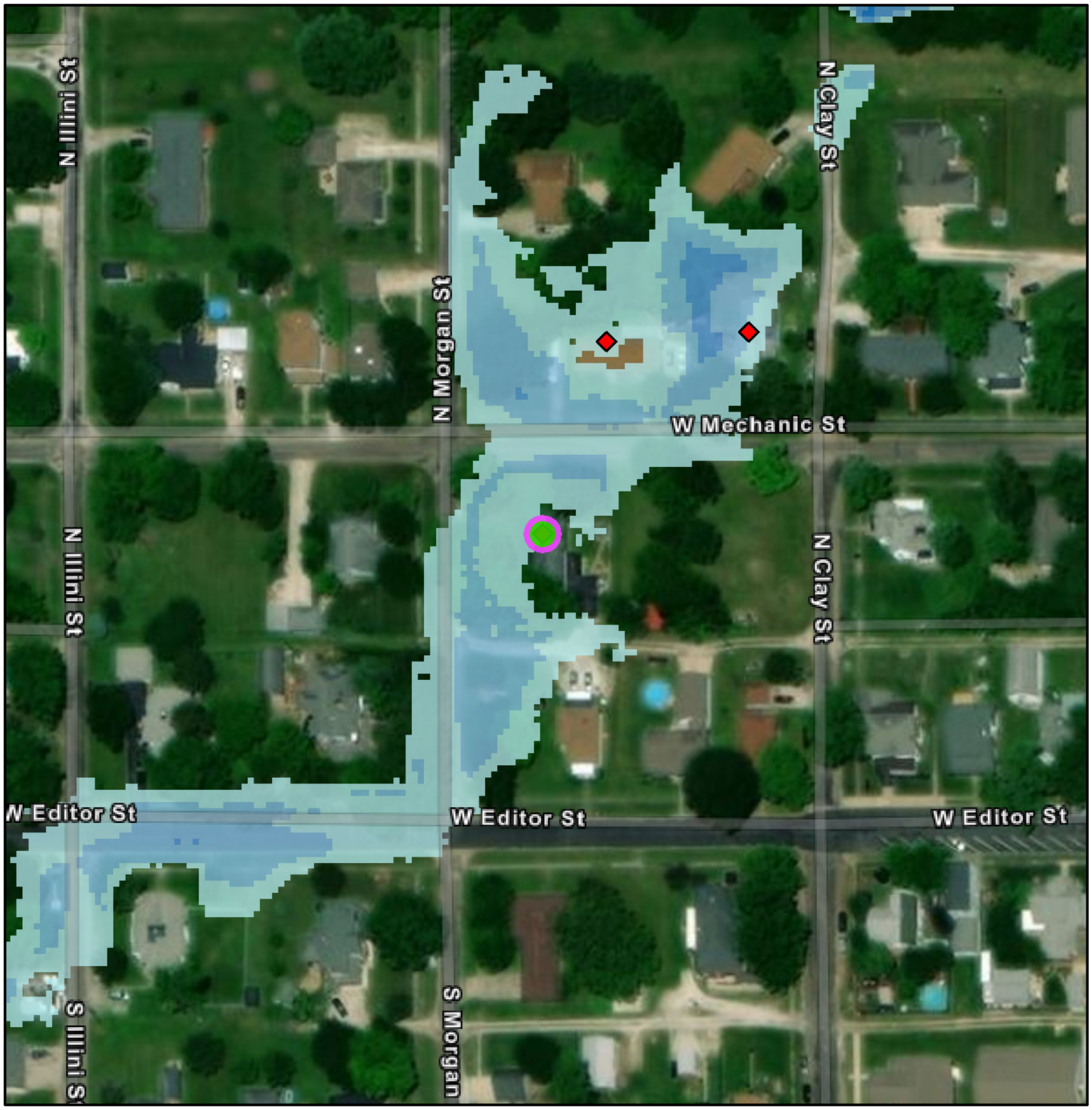
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



Legend

Structures

- Structure
- Selected Structure

1% Depth Grid (ft)

- > 15.0
- 10.1 - 15
- 5.1 - 10
- 3.1 - 5
- 2.1 - 3
- 1.1 - 2
- <= 1.0

117 N MORGAN ST, ASHLAND, IL, 62612 PIN 02-027-013-00

Property Info:

Building Value (2019 US$)
73,217

Stories
1

Area (Sq Ft)
1,504

Foundation Type
Slab

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 0.8%

Percent Chance of Flooding w/in 30 Years: 20.3%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	-1.99	0.03	20
0.2%	-1.87	0.4	290

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet

Legend

Structures

Structure

Selected Structure

1% Depth Grid (ft)

> 15.0

10.1 - 15

5.1 - 10

3.1 - 5

2.1 - 3

1.1 - 2

<= 1.0

303 W MECHANIC ST, ASHLAND, IL, 62612 PIN 02-024-010-00

Property Info:

Building Value (2019 US$)
36,731

Stories
1

Area (Sq Ft)
1,152

Foundation Type
Crawlspace

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	-0.45	8.53	3,130
4%	-0.45	8.53	3,130
2%	-0.24	10.64	3,910
1%	-0.08	12.21	4,490
0.2%	0.07	13.66	5,020

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

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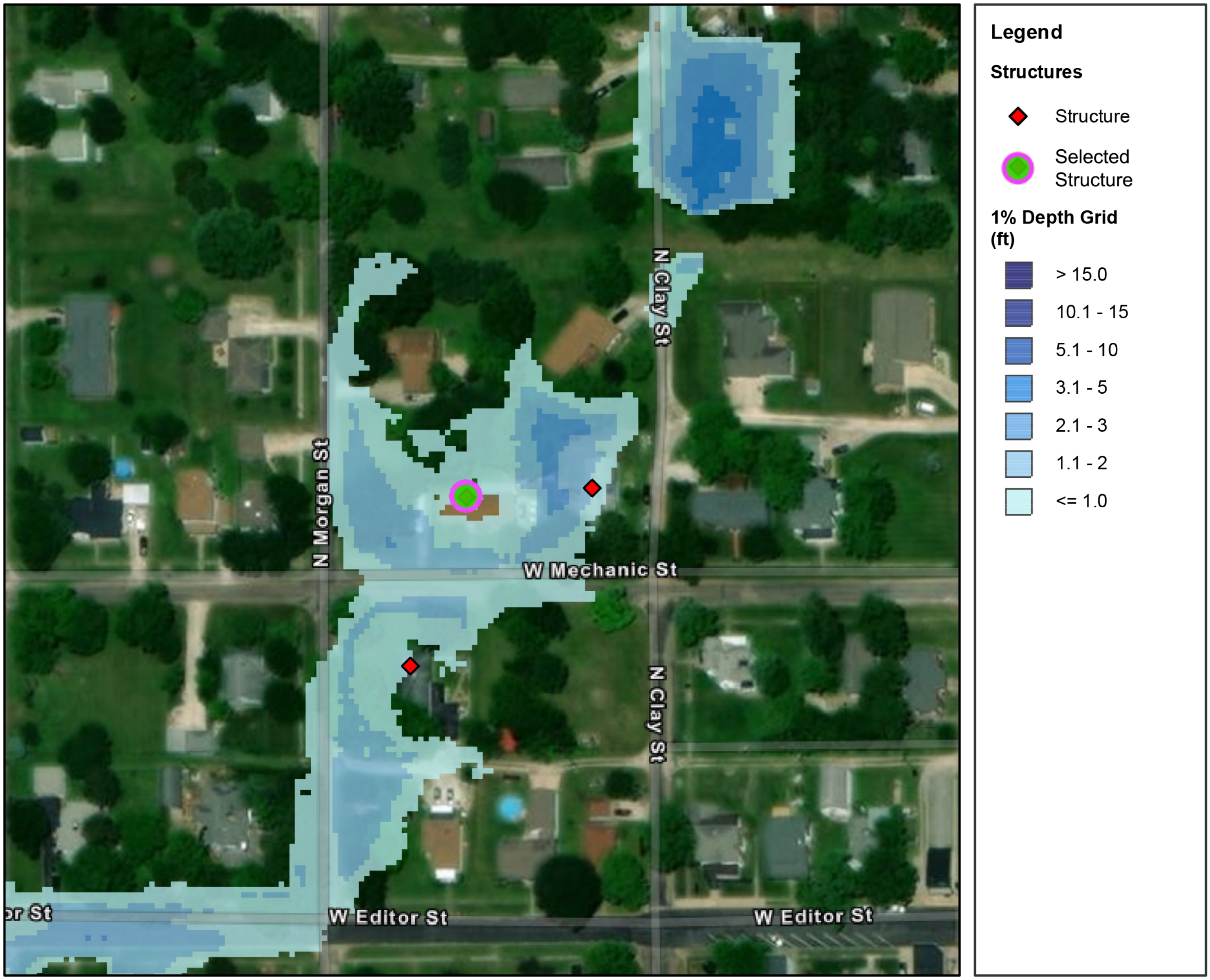
Feet



305 W MECHANIC ST, ASHLAND, IL, 62612 — PIN 02-024-009-00

Property Info:

Building Value (2019 US$)
82,305

Stories
1

Area (Sq Ft)
960

Foundation Type
Slab

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	-1.97	0.08	70
4%	-1.97	0.08	70
2%	-1.78	0.65	530
1%	-1.64	1.09	900
0.2%	-1.5	1.5	1,230

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

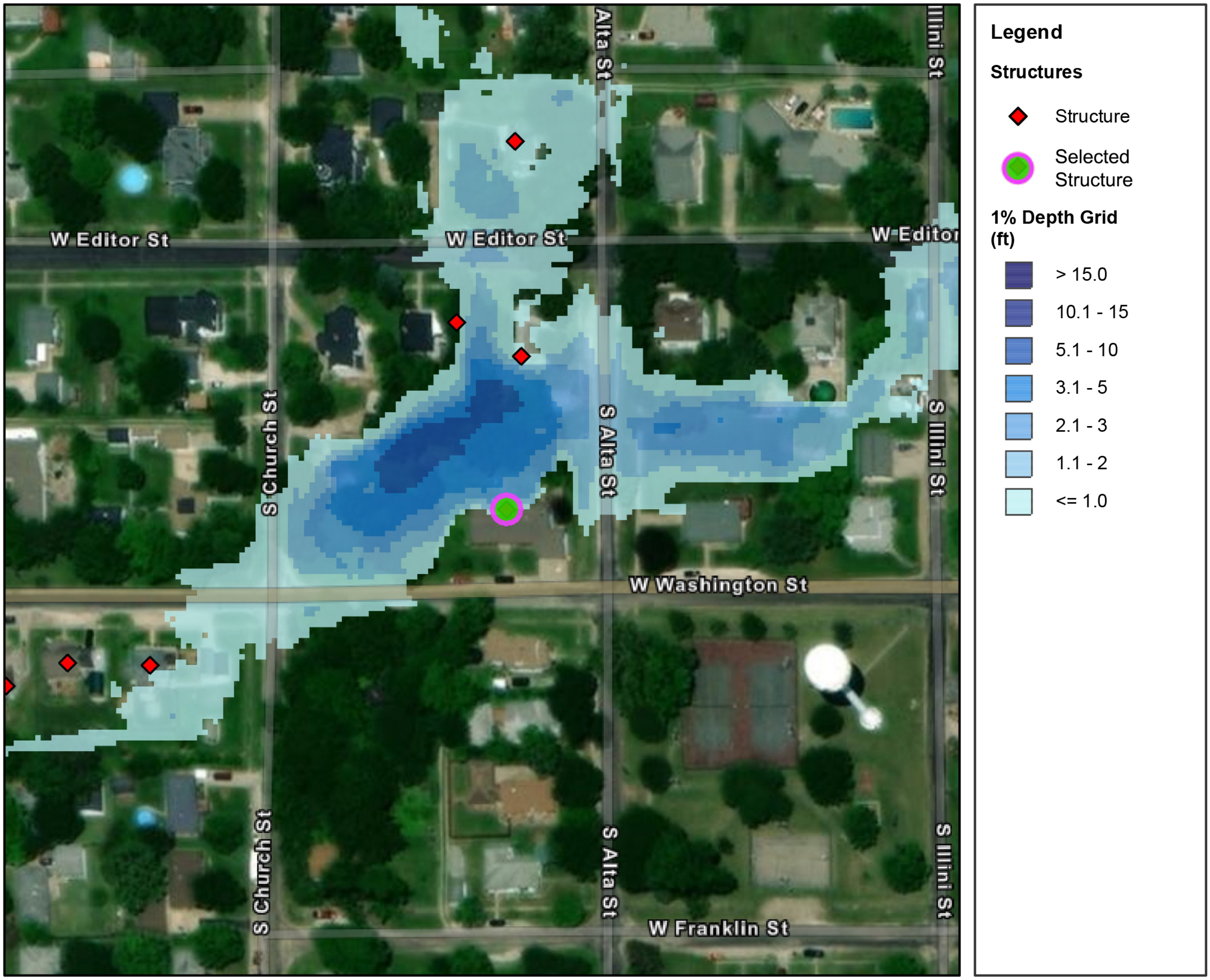
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



605 W WASHINGTON ST, ASHLAND, IL, 62612 — PIN 02-035-013-00

Property Info:

Building Value (2019 US$)
90,050

Stories
1

Area (Sq Ft)
2,276

Foundation Type
Basement (or Garden Level)

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	-1.55	16.27	14,650
4%	-1.55	16.27	14,650
2%	-1.55	16.27	14,650
1%	-1.49	16.57	14,920
0.2%	-1.07	18.67	16,810

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

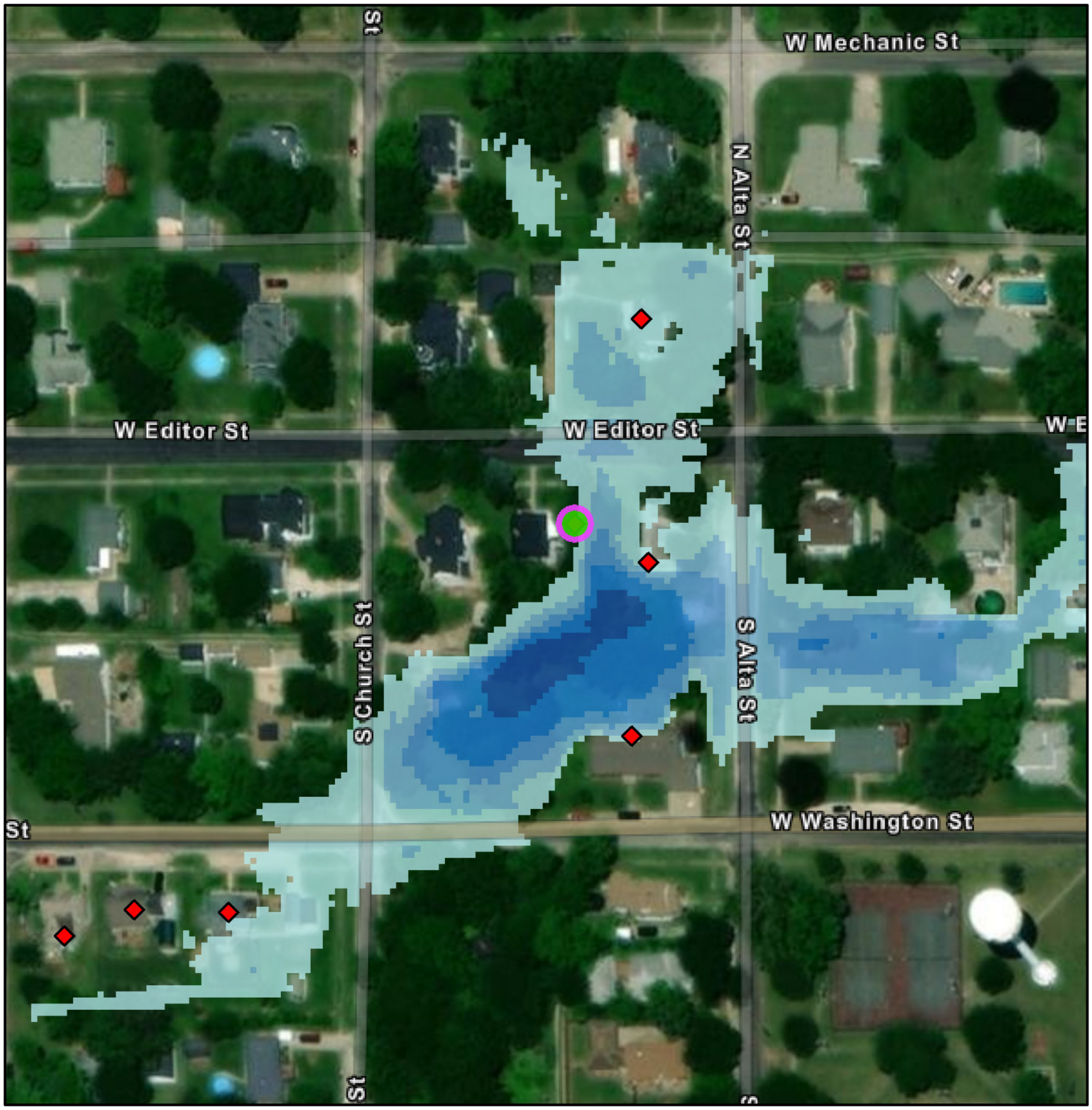
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



Legend

Structures

Structure

Selected Structure

1% Depth Grid (ft)

- > 15.0
- 10.1 - 15
- 5.1 - 10
- 3.1 - 5
- 2.1 - 3
- 1.1 - 2
- <= 1.0

616 W EDITOR ST, ASHLAND, IL, 62612 PIN 02-035-011-00

Property Info:

Building Value (2019 US$)
28,497

Stories
2

Area (Sq Ft)
2,160

Foundation Type
Basement (or Garden Level)

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 0.3%

Percent Chance of Flooding w/in 30 Years: 7.4%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	-2.78	3.11	890

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

N

Scale = 1:2,257

0 62.5 125 250 375

Feet

Legend

Structures

Structure

Selected Structure

1% Depth Grid (ft)

> 15.0

10.1 - 15

5.1 - 10

3.1 - 5

2.1 - 3

1.1 - 2

<= 1.0

708 W WASHINGTON ST, ASHLAND, IL, 62612 PIN 02-036-013-00

Property Info:

Building Value (2019 US$)
34,337

Stories
1

Area (Sq Ft)
800

Foundation Type
Crawlspace

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 1.5%

Percent Chance of Flooding w/in 30 Years: 37.4%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	0.07	13.69	4,700

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

N

Scale = 1:2,257

0 62.5 125 250 375

Feet

712 W WASHINGTON ST, ASHLAND, IL, 62612 PIN 02-036-016-00

Property Info:

Building Value (2019 US$)
45,650

Stories
2

Area (Sq Ft)
1,252

Foundation Type
Crawlspace

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: N/A

Percent Chance of Flooding w/in 30 Years: N/A

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	N/A	N/A	N/A

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

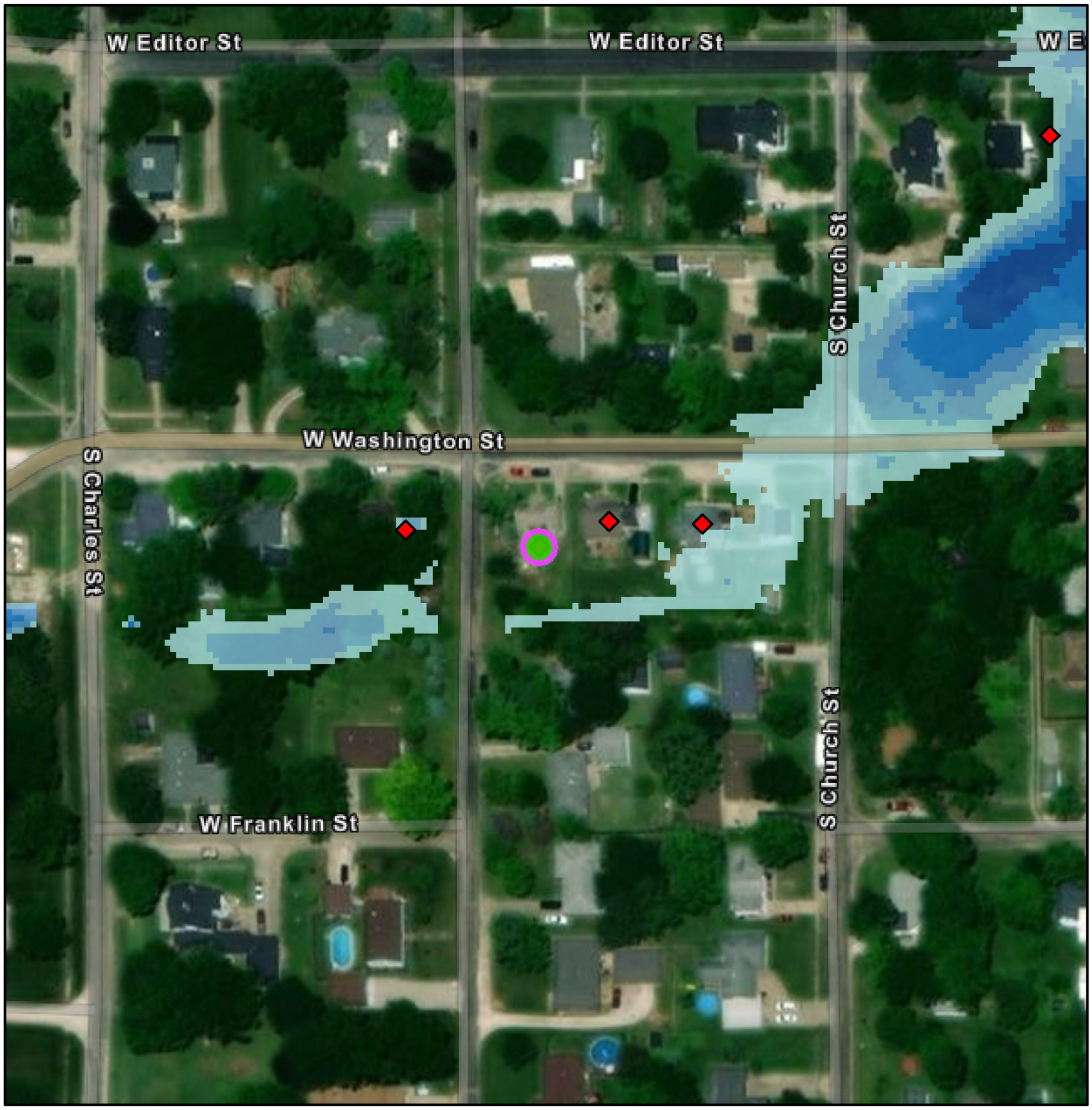
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



Legend

Structures

- Structure
- Selected Structure

1% Depth Grid (ft)

- > 15.0
- 10.1 - 15
- 5.1 - 10
- 3.1 - 5
- 2.1 - 3
- 1.1 - 2
- <= 1.0

716 W WASHINGTON ST, ASHLAND, IL, 62612 — PIN 02-036-014-00

Property Info:

Building Value (2019 US$)
62,331

Stories
2

Area (Sq Ft)
1,525

Foundation Type
Basement (or Garden Level)

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: N/A

Percent Chance of Flooding w/in 30 Years: N/A

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	N/A	N/A	N/A

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet

Legend

Structures

Structure

Selected Structure

1% Depth Grid (ft)

> 15.0

10.1 - 15

5.1 - 10

3.1 - 5

2.1 - 3

1.1 - 2

<= 1.0

804 W WASHINGTON ST, ASHLAND, IL, 62612 PIN 02-036-008-00

Property Info:

Building Value (2019 US$)
49,920

Stories
1

Area (Sq Ft)
728

Foundation Type
Basement (or Garden Level)

Occupancy Type
Residential

Flood Risk:

Annual Percent Chance of Flooding: 10%

Percent Chance of Flooding w/in 30 Years: 95.8%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	0.46	28.75	14,350

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

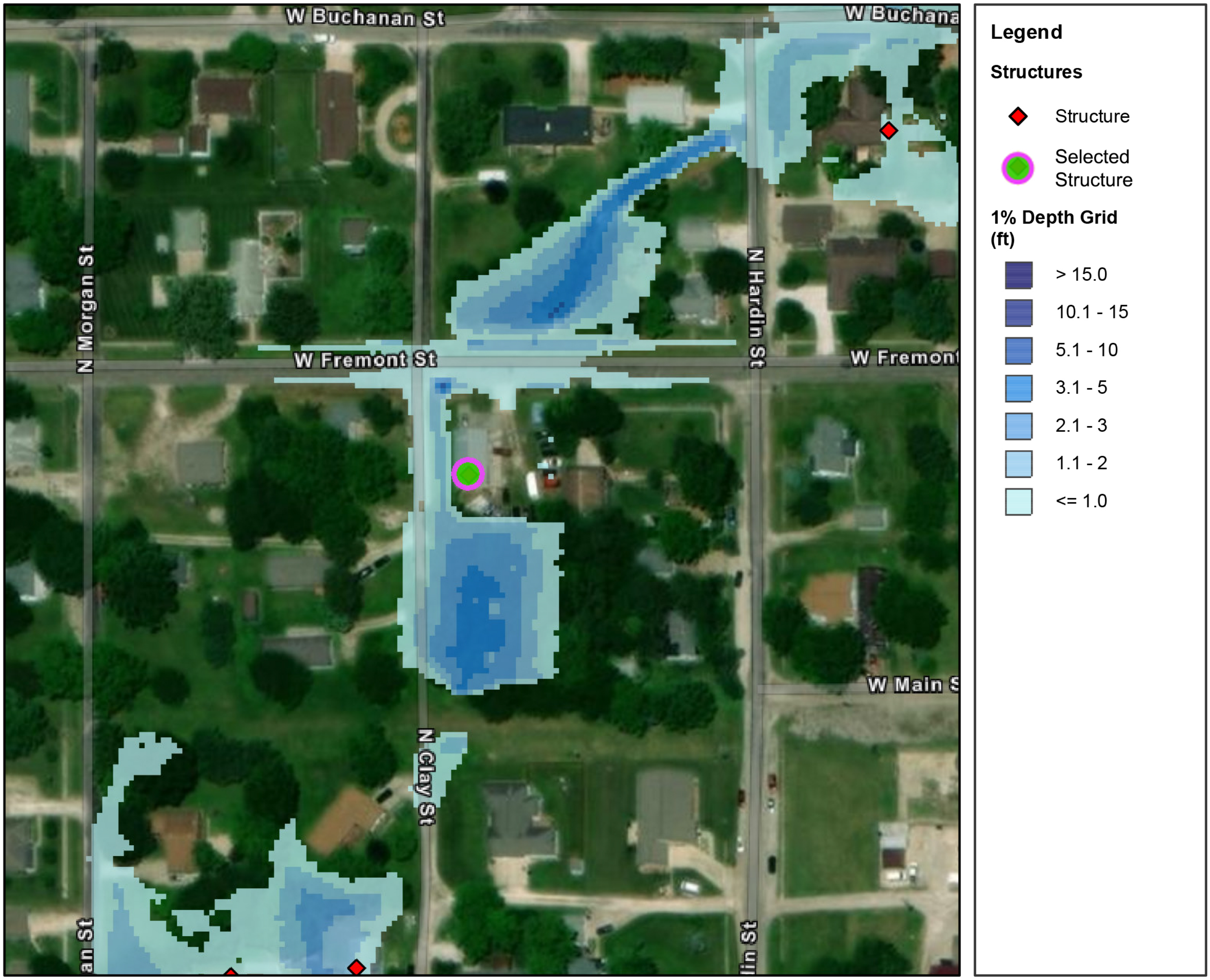
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

Scale = 1:2,257

0 62.5 125 250 375

Feet



W FREMONT ST, ASHLAND, IL, 62612 PIN 02-020-009-00

Property Info:

Building Value (2019 US$)
22,596

Stories
1

Area (Sq Ft)
1,500

Foundation Type
Slab

Occupancy Type
Commercial

Flood Risk:

Annual Percent Chance of Flooding: 0.3%

Percent Chance of Flooding w/in 30 Years: 8.6%

Annual Chance of Flood	Depth from 1st Finished Floor (ft)	Building Damage (%)	Building Losses (2019 US$)
10%	N/A	N/A	N/A
4%	N/A	N/A	N/A
2%	N/A	N/A	N/A
1%	N/A	N/A	N/A
0.2%	0.16	1.59	360

Disclaimer: Elevations presented are not official FEMA BFEs or survey elevations. These values are intended for use in risk assessments, but not for official determinations.

Source: SAFR web map [http://illinoisfloodmaps.org/structureriskassessment/FloodRiskDB] accessed on 7/17/2020

N

Scale = 1:2,257

0 62.5 125 250 375

Feet